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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/516,998	08/16/2005	Thierry Leon Lagarde	15675P559	1367

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EXAMINER

DHINGRA, RAKESH KUMAR

ART UNIT	PAPER NUMBER
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1792

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10/06/2008

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/516,998	Applicant(s) LAGARDE ET AL.	
	Examiner RAKESH K. DHINGRA	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 June 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 December 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>06/08</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments, see pages 4-11, filed 6/26/08, with respect to the rejection(s) of claim(s) 1, 2, 4, 6, 7, 9, 11-13 under 35 USC 103 (a) that Akiyama does not disclose a waveguide structure and also corresponds to RF and not microwave frequency range has been considered and is persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Wu and new references [Lagarde et al (JP 2001-102200 – equivalent of US 6,407,359) and Ikegawa et al (US 6,427,621)] which when combined read on claim 1 limitations. Accordingly claims 1, 4, 9, 12, 13 have been rejected under 35 USC 103 (a) as explained below. Further, claims 2, 5, 6, 7, 8, 11 have also been rejected under 35 USC 103 (a) as explained below. Regarding claims 3 and 10, applicant's arguments regarding Jewett and Kumihashi not curing the deficiency of Akiyama are now moot in view of new grounds of rejection of claim 1, as indicated above and explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various

claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 4, 9, 12, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu (US Patent No. 6,114,811) in view of Lagarde et al (JP 2001-102200 – equivalent of US 6,407,359) and Ikegawa et al (US 6,427,621).

Regarding Claim 1: Wu teach a microwave plasma apparatus comprising:

a plasma excitation device comprising coaxial applicator of microwave energy, of which one end is connected to a source of microwave energy (through microwave transmission chamber 4), the other end being directed to the gas to be excited within a chamber 6, wherein the basic excitation device is arranged in the wall 11 of the chamber, the applicator comprising a central core 10 which is substantially flush with the wall 11 of the chamber, the central core 10 and the thickness of the wall of the chamber being separated by a space 12 coaxial with the central core 10 (e.g. Fig. 1 and col. 4, line 32 to col. 5, line 20).

Wu teach the central core 10 connected to a source of microwave energy (microwave transmission chamber 4) but do not teach the same is a production source of microwave energy, and also do not teach the space between the central core and the chamber wall being completely filled at least at one end of each applicator with a dielectric material such that said material is substantially flush with the level of the wall of the chamber.

Lagarde et al teach a plasma apparatus comprising a process chamber 1 with a plurality of plasma excitation devices 3 each having a microwave applicators 4 that is connected to a separate production source of microwave energy E (e.g. Fig. 1 and col. 4, lines 32 to 60).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a separate production source of microwave energy connected to each central core as taught by Lagarde et al in the apparatus of Wu to enable obtain a desired electromagnetic energy intensity profile over the substrate surface in the plasma chamber.

Wu in view of Lagarde et al do not teach the space between the central core and the chamber wall being completely filled at least at one end of each applicator with a dielectric material such that said material is substantially flush with the level of the wall of the chamber.

Ikegawa et al teach a plasma apparatus comprising a chamber 1 and a plasma excitation source comprising a central core 11 and a dielectric material 16 that completely fills the space between the central core 11 and the chamber wall and the dielectric material 16 is flush with the level 12 of the wall of the chamber. Ikegawa et al also teach that the frequency of supplied electromagnetic waves can be microwaves (e.g. Fig. 1 and col. 4, lines 40-53).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide dielectric material between the central core and the chamber wall as taught by Ikegawa et al in the apparatus of Wu in view of Lagarde et al to facilitate propagation of electromagnetic waves through the space between the central core and the chamber wall, besides also providing electrical insulation there-between.

Regarding Claim 4: Ikegawa et al teach the dielectric material 16 fills the entire coaxial space (Fig. 1).

Regarding Claim 9: Wu teaches a dielectric plate 9 that extends to the interior of the chamber 6 on the interior wall thereof and completely covers the plasma excitation devices 10, 12 (Fig. 1 and col.4, lines 35-55).

Regarding Claim 12: Claim limitation pertaining to pressure of plasma between a value of about 1 millitorr and about a few tens of torr is a functional limitation and since the apparatus of prior art meets all the structural limitations, the apparatus is considered capable of meeting the functional limitations.

In this connection courts have ruled:

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959).

Apparatus claims cover what a device is, not what a device does *Hewlett-Packard Co. V. Bausch & Lomb Inc.*, 15USPQ2d 1525, 1528 (Fed. Cir. 1990)

Regarding Claim 13: Wu teaches the apparatus can have a plurality of applicators (through-openings 14) and arranged in a two dimensional network in the wall 11 of the chamber. Wu further teaches that the number of applicators can be adjusted as per requirement of homogeneity of transmission of microwave energy. Further, it would be obvious to optimize the number of applicators as per process limitations like substrate size and microwave power requirement in the processing chamber 6 (Fig. 1, 2 and col. 5, lines 50-60).

Claim 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu (US 6,114,811) in view of Lagarde et al (JP 2001-102200 – equivalent of US 6,407,359) and Ikegawa et al (US 6,427,621) as applied to claims 1, 4, 9, 12, 13 and further in view of Taniguchi et al (US 6,401,653).

Regarding Claim 2: Wu in view of Lagarde et al and Ikegawa et al teach all limitations of the claim except that the dielectric material refractory.

However use of refractory material like alumina as microwave transmitting material is known in the art as per reference cited hereunder.

Taniguchi et al teach a microwave plasma apparatus comprising a vacuum sealing window 6 made from alumina that is chemically stable and hardly absorbs any microwaves. Taniguchi et al further

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teach an alumina insulator 16 disposed between an inner conductor 41 and an outer conductor 42 of a coaxial tube assembly 4 (e.g. Figs. 3-8 and col. 5, line 20 to col. 7, line 15).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use a ceramic as a dielectric material between the central core and the chamber wall as taught by Taniguchi et al in the apparatus of Wu in view of Lagarde et al and Ikegawa et al as a known dielectric material for use in plasma processing apparatus due to its chemical stability and low microwave absorption.

In this connection courts have ruled:

The selection of a known material based on its suitability for its intended use is prima facie obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu (US 6,114,811) in view of Lagarde et al (JP 2001-102200 – equivalent of US 6,407,359) and Ikegawa et al (US 6,427,621) as applied to claims 1, 4, 9, 12, 13 and further in view of Jewett (US 6,156,667).

Regarding Claim 3: Wu in view of Lagarde et al and Ikegawa et al teach all limitations of the claim except that the dielectric material is an alloy of silica and/or of aluminum nitride and/or of alumina.

Jewett teach a plasma apparatus comprising of a process chamber 10 where a dielectric material 15 faces the plasma generating space and the dielectric material then transfers heat to a cooling instrument 25 through a heat moderating material 20. Jewett further teach that the dielectric material comprises of ceramic composites like a mixture of silica and aluminum nitride or mixture of silica and alumina, which are known suitable dielectric materials for use in plasma processing apparatus (for example, Fig. 1 and col. 9, lines 40-50).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use a dielectric material that is an alloy of silica and/or of aluminum nitride and/or of alumina as taught by Jewett in the apparatus of Wu in view of Lagarde et al and Ikegawa et al as a known

dielectric material for use in plasma processing apparatus to obtain desired heat transfer properties besides transparency to electromagnetic radiation.

In this connection courts have ruled:

The selection of a known material based on its suitability for its intended use is prima facie obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu (US 6,114,811) in view of Lagarde et al (JP 2001-102200 – equivalent of US 6,407,359) and Ikegawa et al (US 6,427,621) as applied to claims 1, 4, 9, 12, 13 and further in view of Dandl (US 5,975,014).

Regarding Claim 5: **Wu in view of Lagarde et al and Ikegawa et al** teach all limitations of the claim except that the length of the dielectric material is equal to $\frac{1}{2}$ times wavelength of the microwaves in the dielectric material.

However it is known in the art to provide length of coaxial member as $\lambda/2$ to obtain maxima of standing waves for optimizing the coupling of microwaves with the chamber.

Dandl teach a microwave plasma apparatus with coaxial transmission line with plurality of stubs located at $\lambda/2$ intervals to obtain maximized microwave coupling at these points. It would be obvious to keep the length of the central core (and hence that of the dielectric material) as $\lambda/2$ to obtain maximized microwave coupling (e.g. Figs. 3, 8 and col. 11, lines 5-30).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use a length of the dielectric material as $\frac{1}{2}$ times wavelength of the microwaves in the dielectric material, as taught by Dandl in the apparatus of Wu in view of Lagarde et al and Ikegawa et al to obtain an optimized electric field energy distribution of the standing waves.

Claim 6, 7, 8, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wu (US 6,114,811) in view of Lagarde et al (JP 2001-102200 – equivalent of US 6,407,359) and Ikegawa et al

(US 6,427,621) as applied to claims 1, 4, 9, 12, 13 and further in view of Maeno et al (US 6,060,836).

Regarding Claims 6, 7: Wu in view of Lagarde et al and Ikegawa et al teach all limitations of the claim except further comprising o-rings inserted between the dielectric, the central core of an applicator and the internal wall of the applicator.

However it is known in the art to provide O-rings between central core and dielectric material to obtain improved sealing, as per reference cited hereunder.

length of coaxial member as $\lambda/2$ to obtain maxima of standing waves for optimizing the coupling of microwaves with the chamber.

Maneo et al teach a microwave plasma apparatus comprising a plasma chamber 4, a coaxial line 20 with a central core 22, an outer conductor 24 and a dielectric material 36 between the central core and the outer conductor. Maneo et al further teach that the dielectric material (insulator) 36 comprises insulators 52 and O-rings 54 for hermetic sealing between the central core 22 and dielectric material 52. It would be obvious to provide similar O-rings between the internal wall of applicator and the chamber wall, in view of teaching of Maneo et al to obtain improved sealing (e.g. Figs. 1, 2 and col. 3, line 65 to col. 4, line 63).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide o-rings inserted between the dielectric, the central core of an applicator and the internal wall of the applicator as taught by Maneo et al in the apparatus of Wu in view of Lagarde et al and Ikegawa et al to obtain improved sealing.

Regarding Claim 7: Taniguchi et al teach O-rings embedded in the inner conductor 41 and outer conductor 42 (Fig. 2).

Regarding Claim 8: Maneo et al teach permanent magnet 40 encapsulated in the central core 22 to enable obtain ECR plasma (e.g. Figs. 1, 2 and col. 3, line 65 to col. 4, line 63) {examiner notes that applicant's disclosure does not indicate criticality of magnet being flush with the wall of the chamber}.

Regarding Claim 11: Maneo et al teach the central core 22 has a cooling water passageway for temperature control of the magnets 40 (not shown in Figures – col. 5, lines 60-65).

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wu (US 6,114,811) in view of Lagarde et al (JP 2001-102200 – equivalent of US 6,407,359) and Ikegawa et al (US 6,427,621) as applied to claims 1, 4, 9, 12, 13 and further in view of Kumihashi et al (US 5,368,685).

Regarding Claim 10: Wu in view of Lagarde et al and Ikegawa et al teach all limitations of the claim including plurality of applicators in the chamber wall 9, and with central core substantially flush with chamber wall 9, but do not teach means for cooling each applicator in the chamber walls.

Applicant has invoked 35 USC 112, 6th Paragraph regarding claim limitation “means for cooling each applicator in the chamber wall” for which the structure disclosed by the applicant comprises cooling of portions of chamber wall 3 between applicators by water circulation through pipes 13 (page 7, lines 27-29). {claim limitation “for cooling each applicator in the chamber wall” is interpreted to mean that by cooling the chamber wall spaces, the applicators 4 will also get cooled – in terms of disclosure at page 7, lines 27-29 and page 10, line 10-13}.

Kumihashi et al teach a plasma apparatus comprising a plasma applicator including microwave generator 1, waveguide 3 and a chamber 10 whose walls are cooled by a cooling mechanism 2 that flows a coolant through coolant passages (for example, Fig. 1 and col. 6, lines 1-5 and col. 9, lines 1-20). It would be obvious to provide cooling of chamber wall as taught by Kumihashi et al, in the apparatus of Wu in view of Lagarde et al and Ikegawa et al to enable cooling of each applicator. Though Kumihashi et al do not teach plurality of applicators, it would be obvious to provide such cooling circuit through-out the wall of chamber to enable cool all the applicators in the wall of the chamber in the apparatus of Wu in view of Lagarde et al and Ikegawa et al. Further, though Kumihashi et al do not explicitly teach that the coolant is water, it is known in the art to use water as a coolant in plasma processing apparatus.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide means for cooling each applicator in the chamber wall as taught by Kumihashi et al in the apparatus of Wu in view of Lagarde et al and Ikegawa et al to obtain temperature control of plasma applicators for obtaining desired electromagnetic intensity and uniformity.

In this connection courts have ruled:

The selection of a known material based on its suitability for its intended use is prima facie obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/
Examiner, Art Unit 1792

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/K. M./
Primary Examiner, Art Unit 1792